SB761
U7N6
#73-10

INSECT DISEASE REPORT

USDA FOREST SERVICE/NORTHERN REGION

Report No. 73-10

5200
April 1973

CANKERS IN NORTH DAKOTA WINDBREAK PLANTINGS SURVEY AND EVALUATION

by

Oscar J. Dooling, Plant Pathologist
Environmental Services

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ABSTRACT

A survey to determine distribution and intensity of cankers and associated damage in North Dakota windbreak plantings of Russian-olive and Siberian elm was conducted in 1972. Four hundred and thirty-five (76 percent) of 574 Russian-olive examined had cankers, and 552 (72 percent) of 769 Siberian elm examined had cankers. Cankers on trees in all windbreaks except one contained the secondary fungi *Cytospora* sp., *Dothichiza* sp., and *Camarosporium* sp. *Tubercularia ulmea*, the reported pathogen, was recovered from only one windbreak. Most cankers were on small twigs and branches. The cause of windbreak decline appears to be herbicide injury, with root pruning caused by close cultivation, and soil compaction caused by livestock exerting minor effects in localized areas. Recommendations are made to reduce windbreak decline.

INTRODUCTION

Planting of trees for protection against climatic extremes and improvement of living conditions in the Great Plains is as old as settlement. Tree planting was considered so important to settlement that Congress passed the Timber Culture Act in 1873 to encourage tree planting on all new homestead lands.

Trees established in the Plains are subjected to greater stresses in moisture, temperature, and wind than trees in naturally forested areas (2, 7). These environmental extremes often damage trees. Agents such as livestock, rodents, fire, insects, diseases, and agricultural chemicals put additional stress on tree growth (10).

A high incidence of cankers, supposedly caused by *Tubercularia ulmea* Carter, was reported on Russian-olive (*Elaeagnus angustifolia* L.) and Siberian elm (*Ulmus pumila* L.) in highway plantings and at Lincoln-Oakes Nursery. Top dieback and tree mortality were also observed in windbreak plantings throughout the State. Prior to the survey, *T. ulmea* was recovered from several species of woody plants collected along Interstate 94 and the nursery.[1/] The Soil Conservation Service, the North Dakota Association of Soil Conservation Districts, the North Dakota Extension Service, and the North Dakota Highway Department feared that *T. ulmea* was widespread in the State and was the cause of windbreak decline. The Division of State and Private Forestry, USDA Forest Service, was requested to evaluate the problem. A survey to determine the distribution and intensity of cankers and associated damage in plantings containing Russian-olive and Siberian elm was conducted during portions of July, August, and September 1972 by D. M. Berg, C. E. Carlson, and O. J. Dooling.

METHODS

The State was divided into five major categories (physiographic regions) based on land use, soils, and climatic factors as defined by Austin (1) (fig. 1):

53 - Dark Brown Glaciated Plains--west central portion.
54 - Rolling Soft Shale Plains--southwestern portion.
55 - Black Glaciated Plains--east central portion.
56 - Red River Valley of the North--eastern portion.
58 - Northern Rolling High Plains--Badlands along the Little Missouri River.

Selection of 12 plantings to sample in each physiographic region was made at random from information compiled by the Soil Conservation Service for an associated study on green ash borers (4). Eleven windbreak plantings were actually sampled in physiographic region 53; 12 each in regions 54 and 55; and nine in region 56. Region 58 was not sampled; there were no Russian-olive or Siberian elm plantings listed in the information furnished by the Soil Conservation Service.

The selected windbreaks were sampled systematically. The first sample tree in each windbreak was drawn at random between one and five, and every fifth tree threrafter was examined. Location, physiographic region, age and length of windbreak, and name of owner or operator were entered on the data sheet. Individual tree data collected were tree

1/ Identifications made by J. C. Carter, Illinois Natural History Survey; E. H. Lloyd, Jr., North Dakota State University; and C. E. Carlson, USDA Forest Service, Missoula, Montana.

number, species, presence of cankers (any lesion on a twig, branch, or stem bearing fungal fruiting bodies of several types), and other damage associated with the cankers. Diameter and height were recorded at the beginning of the survey, but were deleted when it became apparent that they were not correlated with canker incidence.

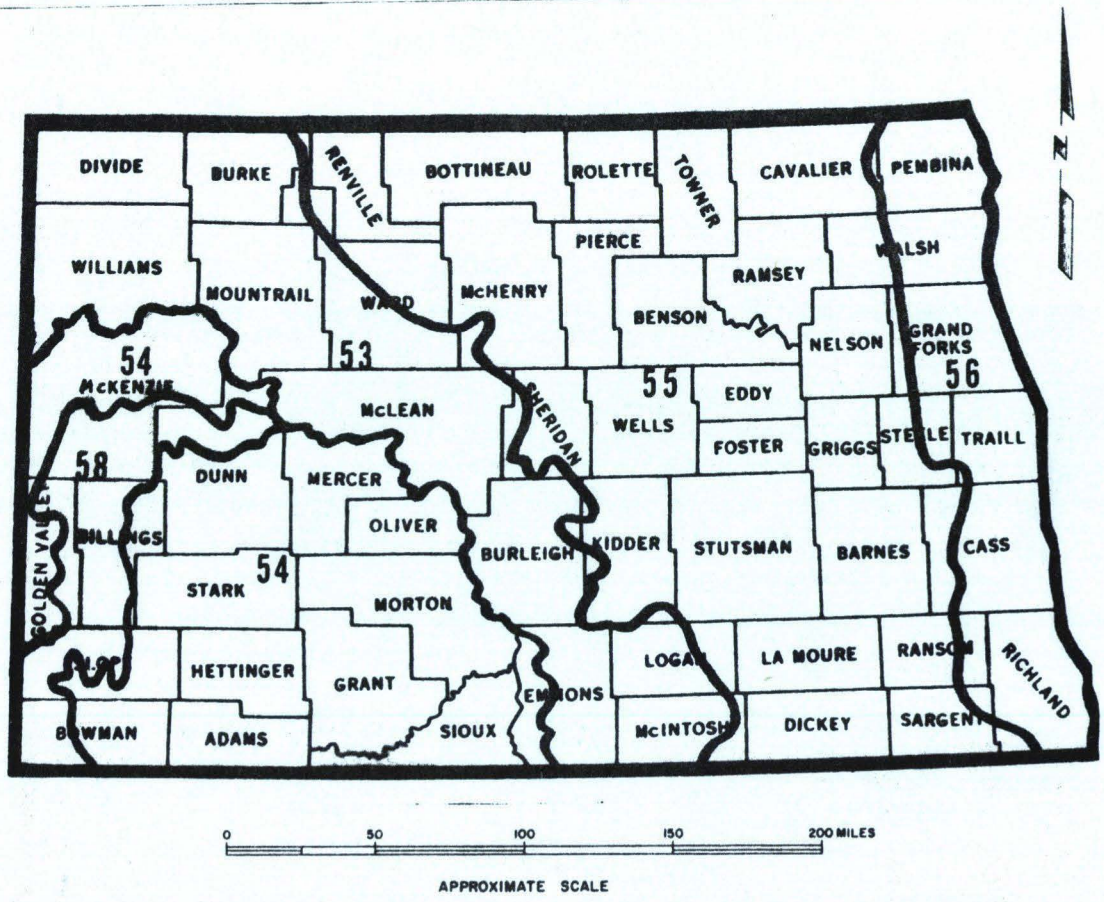

Figure 1.--Physiographic regions of North Dakota

Cankered branches were collected from 31 trees in regions 53, 55, and 56 for laboratory examination and identification of causal organisms. Specimens were not collected from region 54.

RESULTS

Field.--Eight percent of the Russian-olive and six percent of the Siberian elm examined were dead, but the cause of death was not determined. Dieback of tops and branches, mainly associated with cankers, occurred on 72 percent of the Russian-olive and on 65 percent of the Siberian elm examined. Seventy-six percent of the Russian-olive and 72 percent of the Siberian elm examined had cankers. Stem breakage at the canker site occurred on 4 percent of the Russian-olive and on 2 percent of the Siberian elm examined. Wood decay, based on visual symptoms, occurred on less than 1 percent of the Russian-olive and on 3 percent of the

Siberian elm examined. Damage typical of that caused by the herbicide 2,4-D was observed in 45 percent of the windbreaks examined. This same type of damage was visible in many other windbreaks not included in the survey. Field results are summarized in table 1.

Laboratory.--Four species of fungi were identified on 28 of the 31 canker specimens brought to the laboratory.[2/] Three secondary fungi--*Cytospora* sp., *Dothichiza* sp., and *Camarosporium* sp.--were recovered from 26 of the specimens, and *Tubercularia ulmea* was recovered from only two of the specimens, one from Russian-olive and one from Siberian elm (from the same windbreak). Three of the specimens yielded sterile cultures. Laboratory results are summarized in table 2.

DISCUSSION

Several fungi associated with cankers of Russian-olive and Siberian elm have been reported by other workers. A species of *Phomopsis* was isolated from branches of Russian-olive in Ohio (9). *Diaporthe elaeagni* Rehm. has been reported on Russian-olive from Germany (8). Peterson (6) reported *Botryodiplodia theobromae* Pat. cankers on Russian-olive as widespread in the Plains. *B. hypodermia* (Sacc.) Petr. and Syd. has been reported to be the primary cause of Siberian elm cankers in South Dakota (5). Carter (3) first reported and described *Tubercularia ulmea* as the cause of cankers and dieback of Siberian elm in Illinois.

Most of the cankers observed in the survey were associated with either mechanical or apparent chemical injury and dead twigs. Active *T. ulmea* cankers were found in only one windbreak. Other fungi identified in the laboratory are secondary pathogens or saprophytes normally associated with weakened or dead tissue.

HYPOTHESIS

The primary cause of windbreak decline appears to be herbicide injury, with root pruning associated with close cultivation, and soil compaction caused by livestock exerting a minor effect in localized areas. The connection between herbicide injury, cankers, and fungi is a professional opinion of the author based on nondetailed observations. This hypothesis needs further study for clarification.

2/ Identifications made by C. E. Carlson, USDA Forest Service, Missoula, Montana.

Table 1.--Field results of North Dakota canker survey

Physio. region	Number windbreaks sampled	Species	No. trees	Cankered		Dead		Dieback		Breakage		Decay		Windbreaks with herbicide damage	
				No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
53	11	Russian-olive	189	116	61	10	5	115	61	21	11	0	--	2	18
		Siberian elm	180	128	71	4	2	126	70	6	3	7	4		
54	12	Russian-olive	125	111	89	12	10	100	80	3	2	1	< 1	3	25
		Siberian elm	272	196	72	11	4	146	54	3	1	1	< 1		
55	12	Russian-olive	145	110	76	19	13	104	72	2	1	0	--	6	50
		Siberian elm	194	155	80	16	8	151	78	7	4	2	1		
56	9	Russian-olive	115	98	85	4	3	97	84	0	--	0	--	9	100
		Siberian elm	123	73	59	12	10	80	65	2	2	16	13		
Totals	44	Russian-olive	574	435	76	45	8	416	72	26	4	1	< 1	20	45
		Siberian elm	769	552	72	43	6	503	65	18	2	26	3		

Table 2.--Fungi on canker specimens, North Dakota canker survey

Physio. region	Species	Fungi				Totals
		Cytospora	Dothichiza	Camarosporium	Tubercularia	
53	Russian-olive	4	--	--	--	4
	Siberian elm	3	1	--	--	4
55	Russian-olive	1	--	1	1	3
	Siberian elm	5	3	--	1	9
56	Russian-olive	1	1	2	--	4
	Siberian elm	1	3	--	--	4
Totals		15	8	3	2	28

RECOMMENDATIONS

Canker damage in windbreak plantings may be reduced by:

1. Applying herbicides more carefully and reducing drift into windbreaks.

2. Not cultivating within 6 feet of windbreak rows.

3. Excluding livestock from windbreaks.

4. Replacing with nonsusceptible species.

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